DEVELOPING AN ACTION THRESHOLD FOR THRIPS IN THE TEXAS HIGH PLAINS

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Abstract

In the Texas high plains and most of the cotton growing areas of the United States, thrips are a dominating pest during the pre-squaring stage of cotton. The most dominate thrips species affecting irrigated cotton fields in the Texas high plains is the western flower thrips, *Frankliniella occidentalis* (Pergande). This was the fourth year conducting this study. The purpose of this study was to determine at what population density western flower thrips should be subjected to control tactics to prevent yield reduction and significant delayed maturity, to compare two action thresholds for thrips and to determine whether there is a relationship between thrips induced yield reduction and temperature. This study was conducted in irrigated cotton across the Texas high plains. Based on the data collected thus far, cotton appears to be most susceptible to thrips at the cotyledon stage and susceptibility decreases as the plant grows. It has been commonly observed that cotton suffers more damage from thrips under cool temperatures. However, cool temperatures do not make the thrips more damaging, rather the plant's growth is slowed and remains at a more susceptible stage for a longer period of time. Although not certain, the current Texas action threshold for thrips requires revamping to cotyledon stage = 0.5 thrips per plant, 1 true leaf = 1 thrips per plant, 2 true leaves = 1-1.5 thrips per plant, and 3-4 true leaves = 2 thrips per plant. However, more data is required to confirm these thresholds.

Introduction

Thrips are a significant economic pest of cotton during the pre-squaring stage of growth and development in most of the cotton growing areas of the United States. In the Texas high plains, the western flower thrips, *Frankliniella occidentalis* (Pergande), is the primary thrips species comprising 75-95% of the population infesting cotton (Figure 1). In irrigated cotton where thrips populations are historically high (usually areas where there is significant acreage of wheat), many growers opt to utilize preventative insecticide treatments such as in-furrow applications or seed treatments to control thrips. However, where thrips populations are not "guaranteed" to be especially troublesome, preventive treatments may not be necessary and represent an unnecessary expense. In these situations, well timed banded foliar insecticide applications for thrips control may be more profitable. Currently, the treatment threshold for thrips on irrigated cotton in the Texas high plains occurs when the average total thrips per plant equals or exceeds the number of true leaves.

Additionally, thrips damage to cotton appears to be most severe in years when cool early-season temperatures persist. However, at what temperatures damage is most severe is not known.

Materials and Methods

This study was conducted on irrigated cotton during 2007-2010 across 19 locations (Table 1). However, not all sites yielded usable data. In 2007-08, plots at all locations were 2-rows wide × 100-ft long, while in 2009-10 all plots were 4-rows wide × 100-ft. Plots were arranged in a RCB design with 4 replicates. The foliar treatment regimes are outlined in (Table 2). These treatments were simply a means of manipulating the thrips populations at different times in an attempt to focus on when thrips feeding is most damaging.

All foliar sprays consisted of Orthene 97 (acephate) applied at 3 oz-product/acre with a CO_2 pressurized hand boom calibrated to deliver 10 gallons/acre. Thrips were counted weekly by counting the number of larvae and adult thrips from 10 plants per plot. Whole plants were removed and inspected in the field. Each plot was harvested in its entirety in 2007, using a stripper with a burr extractor. In 2008-2009, a 1/1000th acre portion was harvested from each plot using an HB hand stripper. Yields were converted to proportion of yield relative to the highest yielding plot for each test site. Data were analyzed using linear regression (Sigma Plot 2008). Total thrips by crops stage and temperature were correlated with yield. Crops stages included cotyledon, 1 true leaf, 2 true leaves, 3 true leaves and 4 true leaves. Only leaves approximately the size of a quarter were counted as true leaves. Temperature was segregated based on minimum daily temperature. Those with minimum daily temperatures of 60° F or less were considered cold and those above that threshold were considered warm. A 10% reduction in yield was considered unacceptable.

Table 1. Tests sites and reliability of data.

2007		2008		2009		2010	
Bailey	Acceptable	Bailey	Acceptable	Bailey	Hailed out	Bailey	Nematodes
		Crosby	Acceptable	Crosby	Hailed out	Crosby	Acceptable
		Gaines	Acceptable	Gaines	Insufficient thrips	Dawson	Insufficient thrips
		Hale	Acceptable	Hale	Weedy	Lamb	Acceptable
		Hockley	Acceptable	Moore	Herbicide damage	Moore	Acceptable
		Lubbock	Insufficient thrips	Lubbock	Insufficient thrips	Castro	Insufficient irrigation
						Hale	Poor stand

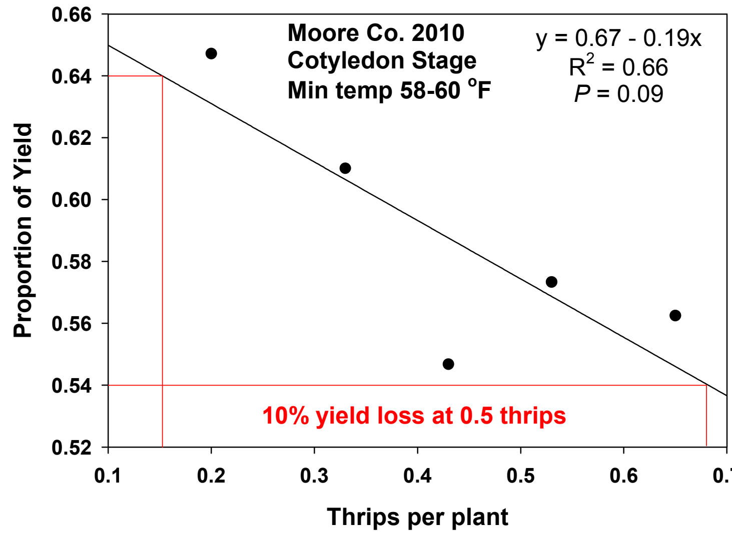
Table 2. Foliar treatment regime timings.

	2007	2008	2009-10
1) Untreated check	X	X	X
2) Automatic treatment on week 1	X	X	X
3) Automatic treatment on weeks 1 and 2 (only week 2 in 2008)	X		X
4) Automatic treatment on weeks 1, 2 and 3	X	X	X
5) Automatic treatment on week 2		X	X
6) Automatic treatment on weeks 2 and 3	X	X	X
7) Treatment based on the Texas AgriLife Extension Threshold[a]	X	X	X
8) Treatment based on the above threshold with 30% larvae	X	X	

[a]One thrips per plant from plant emergence through the first true leaf stage, and one thrips per true leaf thereafter until the cotton has 4 to 5 true leaves

Results and Discussion

Under cool conditions, yield of cotton in Moore County was negatively correlated with thrips at the cotyledon stage (Figure 1, top). At this stage, based on the regression model, approximately 0.5 thrips per plant resulted in a 10% yield reduction. Results were similar for the Gaines County in 2008 (Figure 1, bottom). However, the cotton in Gaines County was approaching the 1 true leaf stage when the thrips were counted.



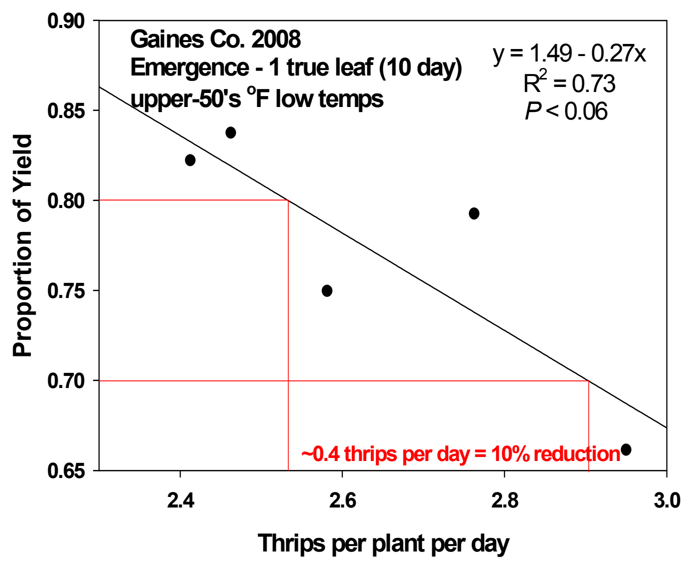


Figure 1. Relationship between thrips per plant and proportion of yield at the cotyledon stage under cool conditions in Moore (top) and Gaines (bottom) counties.

At the 1 true leaf stage under cool conditions, approximately 1 thrips per plant was correlated with a 10% yield reduction (Figure 2), while approximately 2 thrips per plant were required at the 2 true leaf stage (Figure 3). None of the sites experienced temperatures ≤ 60° F at the 3-4 true leaf stage.

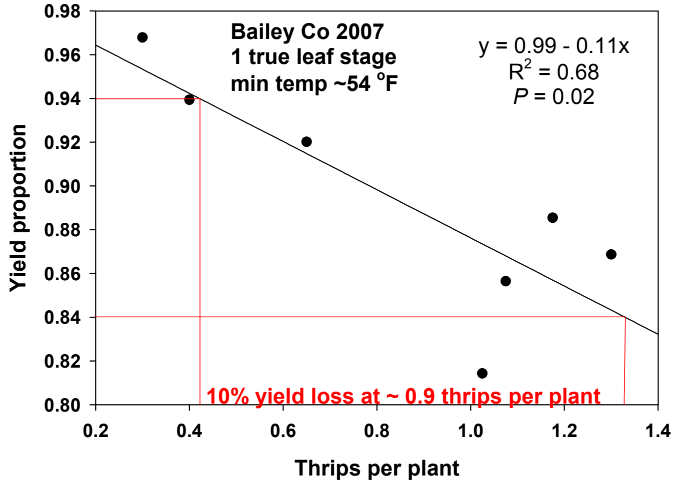
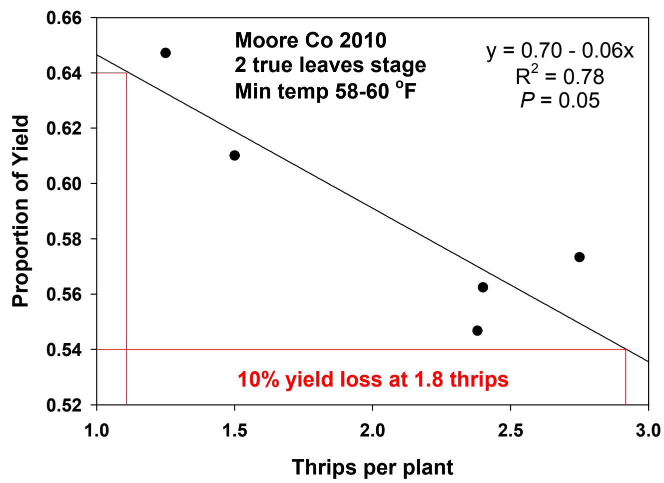


Figure 2. Relationship between thrips per plant and proportion of yield at the 1 true leaf stage under cool conditions in Bailey county.



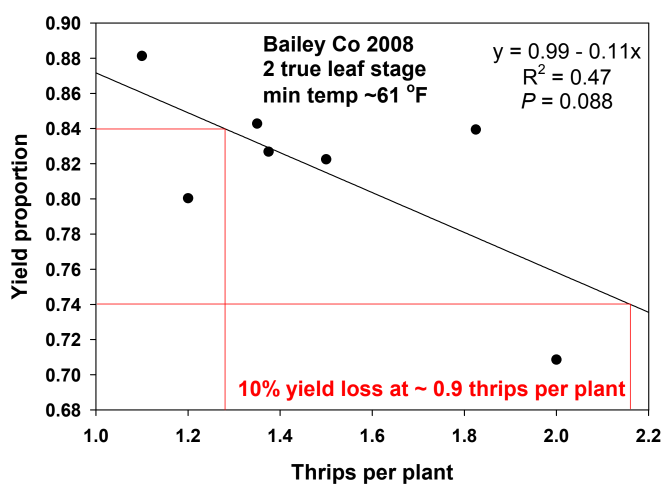


Figure 3. Relationship between thrips per plant and proportion of yield at the 2 true leaf stage under cool conditions in Moore (top) and Bailey (bottom) counties.

Under warm conditions (minimum daily temperatures > 60° F), the relationship between thrips at the cotyledon stage and yield was negatively correlated, although the R^2 was low (Figure 4). Similar to the data collected under cool conditions, the model suggests that 0.4 thrips per plant resulted in a 10% yield reduction. Also, similar to the relationships observed under cool conditions, at the 1 and 2 true leaf stages, 0.9 and 1.4 thrips per plant respectively to result in a 10% yield reduction, respectively.

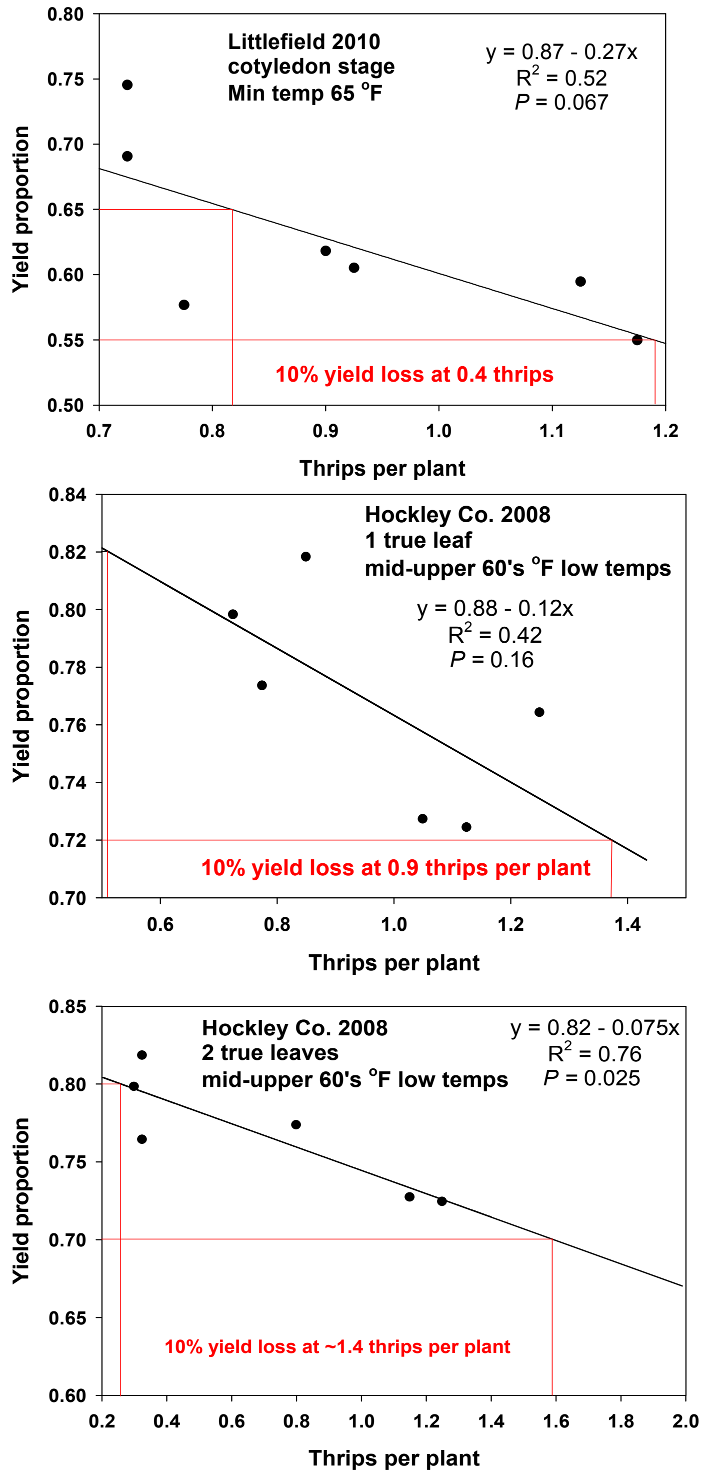


Figure 4. Relationship between thrips per plant and proportion of yield under warm conditions at the 1 true leaf stage (top), 2 true leaf stage (middle) and 3-4 true leaf stage (bottom).

After 2 true leaves, under warm conditions, the cotton at all locations was rapidly growing and relationships were difficult to discern. However, in Hale County in 2008 when the cotton was a mixture of 3 and 4 true leaves, a weak but significant relationship between thrips and yield was detected (Figure 5). At this point, 2 thrips per plant appeared to result in a 10% yield reduction.

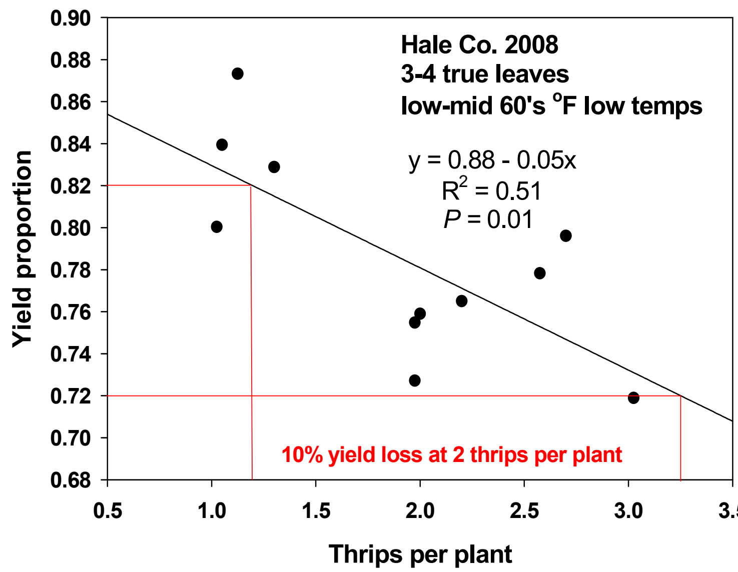


Figure 5. Relationship between thrips per plant and proportion of yield under warm conditions at the 3-4 true leaf stage.

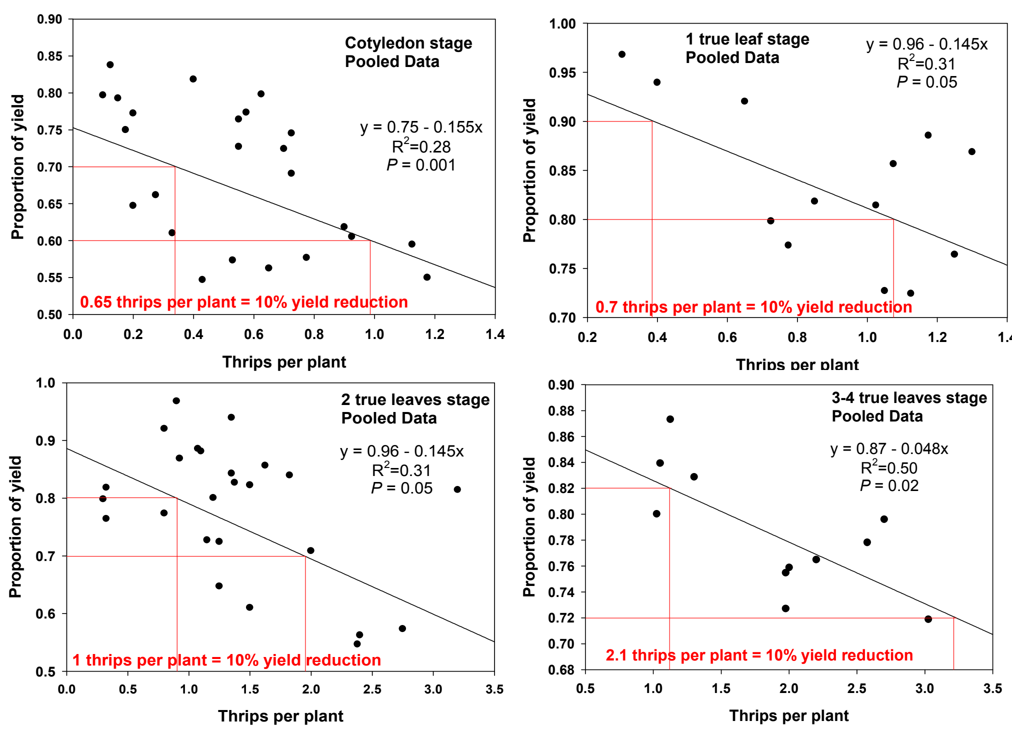


Figure 6. Relationship between thrips per plant and proportion of yield from pooled temperature data (cool and warm) at various stages of crop development.

Based on these correlations, temperature did not appear to affect the number of thrips necessary to cause a 10% reduction in yield, regardless of crop stage. Because of this lack of differences, the data were pooled across temperature and sites in accordance with stage of growth (Figure 6). Although statistically significant, the R^2 values for the pooled data were much lower than desired. This was unavoidable and due to differences in field conditions, varieties, etc. across test sites. However, the pooled data continued to reflect similar trends observed at individual sites with some exception. The number of thrips necessary to result in a 10% yield reduction by crop stage were as follows: cotyledon stage = 0.65 thrips per plant, 1 true leaf stage = 0.7 thrips per plant, 2 true leaf stage = 1 thrips per plant and 3-4 true leaf stage = 2.1 thrips per plant.

It is obvious that thrips are most damaging to cotton during the early stages of growth, particularly cotyledon to 1 true leaf, and that susceptibility declines with plant growth. Additionally, common observation suggests that thrips damage is most severe during periods of cool conditions. However, the impact of cool temperatures does not appear to be an effect on the thrips as much as an impact on the plant. Additionally, cool temperatures do not necessarily make the cotton more susceptible to thrips, but appears to suppress cotton development, thus keeping the plant at a more susceptible stage for a longer period of time.

Based on the data collected thus far, it is obvious that the Texas action threshold for thrips in cotton does need to be altered, but should remain dynamic based on plant growth stage (Table 3).

Table 3. Threshold comparison

Threshold	Cotton Stage	No. Thrips per Plant
Old Threshold	Cotyledon – 1 true leaf	1
	2 true leaves	2
	3 true leaves	3
	4 true leaves	4
Possible New Threshold	Cotyledon	0.5
	1 true leaf	1
	2 true leaves	1-1.5
	3-4 true leaves	2

Summary

Based on the data collected thus far, cotton appears to be most susceptible to thrips at the cotyledon stage and susceptibility decreases as the plant grows. It has been commonly observed that cotton suffers more damage from thrips under cool temperatures. However, cool temperatures do not make the thrips more damaging, rather the plant's growth is slowed and remains at a more susceptible stage for a longer period of time.

Acknowledgements

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